Golden Scrutiny | Compositional Subtlety

Devon Sams

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GOLDEN SCRUTINY

Request for Approval of Project Research Book
Presented to:

Peter Pittman

and to the
Faculty of the Department of Architecture
College of Architecture and Construction Management

By

Devon Sams

In partial fulfillment of the requirements for the Degree

Bachelor of Architecture

Kennesaw State University
Marietta, Georgia

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Dedication & Acknowledgments:

I never imagined this day would come, but it was not a journey I took alone. For that I am forever grateful. I would like to dedicate this book to my family and the architecture department at Kennesaw State University. To get through five years of Architecture is no small feat and this amazing and talented group of Professors and Friends have been the best support system a guy could ask for. My family knows all too well the trials and tribulations I have been through and I know that without them this task of completing my Bachelor’s in Architecture would have never been possible. My mom with her enthusiasm and motivation. To my dad for his uplifting encouragement and wise critiques. To my sister for always keeping me on my toes and the undying admiration I have for her.

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A special thanks to my thesis advisors. I have admired and appreciated these two mentors from day 1. They know how to push me beyond what I thought I am capable of and have shown an incredible amount of wisdom and patience through my process. I will always be humbled for the pleasure of being taught by you Professor Pittman and Professor Farooq. I look forward to our continued friendship. Thank you for believing in me.
“The true work of art is but a shadow of the divine perfection.”

- Michelangelo
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CHAPTER 1 | INTRODUCTION
Proportion as a central principle in architectural theory is a system utilized to create a sense of harmony and order in design. The golden ratio specifically has been studied and applied for its unique qualities and relationships to nature, human proportion and geometry. Some of the most subtly complex designs in art and architecture are based on the golden ratio as its compositional tool, creating a combination of mathematical precision and art.

By understanding the golden ratio in its compositional and spatial qualities, I am proposing a unique study of the relevance and use of the system in architecture through exploration and interrogation of architectural follies. To create a foundation for this assessment I am researching the methods in which the system was applied by architects and artists of the past. With this understanding I am implementing a series of experiments in formal and ordering strategies to create a series of designs that utilize the golden ratio with unique manipulations to the geometries and mathematics.

The fundamental desire of this approach is to study an obscure ancient system to uncover the capabilities and significance it has in order to compose and create space in architecture. Through my studies I am seeking to understand how to create with it, its ability to govern the order of design, and ultimately how the golden ratio becomes a generative tool for architecture. For the study, this process is the interchange between drawing and composing spaces, digitally fabricating, and producing an architecture that will lead to a deeper learning and appreciation of the system.

1.1 | Hypothesis

Proportion as a central principle in architectural theory is a system utilized to create a sense of harmony and order in design. The golden ratio specifically has been studied and applied for its unique qualities and relationships to nature, human proportion and geometry. Some of the most subtly complex designs in art and architecture are based on the golden ratio as its compositional tool, creating a combination of mathematical precision and art.

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GOLDEN RATIO

GEOMETRY
- 2D drawings
- 3D Spaces
- Order in Formalism
- Spatial Decision Making

COMPOSITION
- Framework
- Calculation
- Proportion
- Precision in Detailing
- Prescription of Rules

ARCHITECTURE
- Fabrication
- Process Drawings, Models, Rendered Experiences & Literature Reflection

MATHEMATICS
- Translation
- Precision

EXPERIMENTATION
- Discovery
- Interrogation

FOLLY DESIGN
- Research
- History
- Theory

U R B A N  P L A N N I N G
1.2 | Defining the Process

The golden ratio in relation to architecture revolves around the use of composition, geometry and mathematics. The mathematical ratio informs a specific set of parameters that a design can adhere to and is believed that, when utilized properly, gives a creation a beautiful aesthetic. My approach to understanding this system is by exploring its specific functions and how ‘I’ as a designer can inform my design with the golden ratio as the key principle.

My research examines a comprehensive set of studies and explores through a set of experiments in both drawing, model making and digital fabrication to combine the different components of the ratio into architecture.

In order to evaluate and use the golden ratio it is important to understand where it exists and how it has been utilized throughout history.
Like architecture, the use of the golden ratio is multi-disciplinary. It’s more than the number sequence 1.618... or even the ratio relationship. It’s a tool for mathematical relationships, geometrical construction, and compositional detailing that makes the ratio a unique system important in architecture.

Now architecture is a visual art and the golden number is an aesthetic phenomenon, because this ratio of balanced inequality between two magnitudes \((a : b)\) supposedly pleases us all more than any other ratio. The law valid for this is: things are what they appear to us to be, and not what they really are. Aesthetic ratios however are approximate and allow for individual fluctuations. What matters in aesthetics is solely the impression. Conversely, for geometry and mathematics they are what they really are, objectively. The mathematical ratios are absolute and rigorously precise. This idea of preciseness has to be considered when evaluating the different relationships in architecture in aesthetics, because aesthetics ratios are qualitative, whereas mathematical ones are quantitative.

Composition is the art of combining the different parts of a whole: the number of these combinations is almost unlimited and represents a varied cast field for the imagination and artistic freedom of the artist. But whatever combination is chosen, it must, in order to be harmonious, obey the law of the similar. If a composition strays from the original laws or rules set forth by the system, the creation becomes obviously corrupt in a non-productive sense. Corruption in form and manipulation of shapes and order can produce intriguing results, but only on the basis of following the system, accordingly.

The case studies and examples to follow will demonstrate the principles of mathematics, geometry and composition discussed above. It’s important to recognize and study these works to properly evaluate how they can connect to create an architecture, but more importantly how they have been demonstrated with their use of the golden ratio.

**Mathematics**

The studies will revolve around the utilization of the mathematical ratio and its ability to govern relations between ratios and proportion. Ascertaining to scale and measurement.
Geometry

Architects utilize geometry to define spatial forms in design. It helps to reconcile the larger portions to the smaller ones. Exploring different geometries can achieve desired effects in proportion as well.

Composition

The composition of a design acts as the framework and strategy. Compositional balance can determine architectural factors such as hierarchy, symmetry | asymmetry, harmony | chaos, etc.
1.4 Documented Uses Timeline

**Great Pyramid of Giza**
Constructed by the ancient Egyptians with the golden ratio in mind, although direct use of mathematics for the ratio was not used. It is clear through other works of art that the Egyptians used this ratio purposefully.

**Euclid**
Euclid wrote many books within his Elements series. Book V has information about ratios and proportions. He also coined the term the “golden mean”.

**Boethius**
He believed that he could unlock the universe’s secrets by discovering this ratio. He used arithmetic as a way to show ratio relationships. Boethius found harmonious relationships within mathematics, the bible, geometry and music.

**Phidias & the Parthenon**
Phidias was a Greek sculptor and mathematician. He studied the ratio phi and applied it to the design of sculptures for the Parthenon.

**Aristotle**
Aristotle came up with five different ways numbers can be relational or proportional to one another in accordance to the golden ratio.

**The Stupa of Borobudur**
This sacred Buddhist structure in Java, Indonesia uses the golden ratio in its structures. Mathematics and theology are heavily rooted in Buddhism which often talks of the “golden rule”. 
Leonardo Fibonacci

Fibonacci discovered a pattern of numbers that had golden ratio properties. The sequence is where you take the sum of the two previous numbers to get the next number in the series.

Johannes Kepler

Kepler is famous for his “Kepler’s Triangle”. For this he was able to combine his knowledge of the Pythagorean theorem and golden ratio. He also discovered the elliptical nature of the planetary orbits through mathematical calculations using the golden ratio.

Penrose Tiles

Before this time, it was thought that you couldn’t completely tile a floor with the tile having 5 sides. Using an asymmetrical design, Penrose discovered that you could use 5 sided tiles as long as you used them in accordance with phi or the golden ratio.

Leonardo Davinci

DaVinci was a multi-talented individual who excelled in many fields such as architecture, art, mathematics, and engineering. He deliberately used the golden ratio as derived from the Fibonacci sequence on a number of his works including “The Vitruvian Man”.

Modulor Man

Le Corbusier developed the Modulor in the long tradition of Vitruvius, Leonardo da Vinci’s Vitruvian Man, and other works to discover mathematical proportions in the human body and then to use that knowledge to improve both the appearance and function of architecture.

Quasi-crystals

Discovery of a new crystal found to also have golden ratio properties. Typically crystals form with 2, 3, 4, and 6-fold rotational symmetries. The quasi-crystal has 5-fold symmetry that was previously thought to be impossible.
For Vitruvius the educated architect has to know arithmetic and geometry. Thus his own rules of design combine both methods: all plans of temples are completely developed by geometrical partitions and relations, with the round temple even the elevation. Arithmetic modular operations using the lower diameter of the column as the base module regulate the dimensions and proportions of the columns and intercolumniations. Here Vitruvius uses geometrical methods too the height of the entablature and its decoration and the tapering of the shafts are bound to the columns’ dimensions. Even the modulus is derived from a division of the temple’s width dependent on type. So this is where we should start in order to consider the role of the Golden Section in architectural theory.
This interrelationship of modularity and geometry is also found in the detailed analysis of the proportions of the human body. Vitruvius presents his canon, the famous figure of a man in circle and square, in support of his claim that “no Temple can have a rational composition without symmetry and proportion, that is, if it has not an exact calculation of members like a well-shaped man”. So the body is a model by virtue of its perfection of symmetrical shaping first and foremost and not in its inherent proportions, which is often misunderstood. The human body, as an example of modular creation from nature, is chosen by Vitruvius as a paradigm for the required rules of proportion and thus his studies acted as a precedent for architectural theorists illustrated below.

Zeising: The Proportions of a man’s Skeleton
Pacioli: Divina Proportion of the Head
Le Corbusier: Man in Proportioned Square
The ancient Greeks studied the Platonic solids extensively. Some sources credit Pythagoras with their discovery. Other evidence suggests that he may have only been familiar with the tetrahedron, cube, and dodecahedron and that the discovery of the octahedron and icosahedron belong to Theaetetus, a contemporary of Plato. In any case, Theaetetus gave a mathematical description of all five and may have been responsible for the first known proof that no other convex regular polyhedra exist. Johannes Kepler’s studies of the platonic solids led to understanding the orbits of the planets, giving even more significance to the connection of the golden ratio to the divine.

It is well known that the simplest regular polyhedron, the tetrahedron, is contained inside the cube. Therefore it can be constructed with half the vertices of a cube. The dual of the later is the octahedron, so its vertices are the midpoints of the faces of the cube. All these solids have in common the fact that their Cartesian coordinates do not involve the Golden Ratio. In fact, all of them can be defined by points in space with integer coordinates. On the other hand, for constructing the solids in the second group, their vertices in cartesian coordinates must contain the Golden Ratio. The vertices of the Icosahedron can be easily obtained from three mutually orthogonal Golden rectangles, whose sides are in the golden proportion.

The importance of this study revolves around how the golden ratio not only start to inform shape and space, but how its governing system already establishes a clear set of parameters.
Icosahedron  
The vertices of the icosahedron are defined by three mutually orthogonal golden rectangles.

Dual Dodecahedron  
Extending the three Golden rectangles of a dual dodecahedron until three Golden rectangles are obtained.

Dodecahedron  
The vertices of the dodecahedron can be obtained from the cube and three mutually orthogonal Golden rectangles.

Double Pentadodecahedron  
The double pentadodecahedron has a small stellated dodecahedron. Notice that this double stellation contains 5 powers of the Golden Ratio.

Small Stellated Dodecahedron  
The small stellated dodecahedron contains three powers of the Golden Ratio. This can be clearly appreciated in its pentagram faces.

Great Stellated Dodecahedron  
The outermost black bullets describe the $1: \phi^2$ rectangles of a dodecahedron, whereas the gray bullets are the vertices of a cube.
1.6 | The Geometrization of Architectural Form

Transition from the classical vocabulary to subsequent vocabulary consisting of geometric forms first appeared in the Greek temple. This is the most intriguing aspect of the historical development of architectural form. In the development of architectural form identity of conception and perception have been a constant driving force. According to this, the geometrization of architectural form would have arisen from the desire to achieve this identity between conceived form and perceived form.

Pantheon | Trajan, Hadrian

The Pantheon is the perfect example of a line of thought that sees the foundations of all architecture in simple, basic geometric forms. The form of this building is determined by circle, cylinder and hemisphere. The use of simple geometric forms in the design of buildings goes back to the beginning of architecture.

Villa Rotunda | Leon Alberti Batista

The Villa is derived from a common geometrical rules. The ground plan is based on a square. The external form is dominated by the porticoes set in front of all four sides of the main cube. In this building, the four horizontal directions are gathered into a centre. The hearth of the plan is the circular hall. The plan of building is not just one square, but a concentric series of five. The size of each one is determined by the radius of a circle circumscribed about next smallest. The cross-section through the Villa Rotunda is also a composition of circles and squares.

Concept for an Agricultural Lodge | Claude Nicholas Ledoux

In order to create a symbolic order, Ledoux recommended that architects use simple geometrical solids and figures. He accepted the importance of proportion as a source of beauty and for convenience and economy. For him, the geometrical figures and bodies epitomized ideal beauty and they were the elemental notes of architectural composition.
2.1 | Method of Inquiry

After understanding all the varieties of practices and methods in which the ratio could be utilized I thought it would be important to test some of the thoughts on utilization of the golden ratio to demonstrate and begin to conceive how the ratio can be applied to my own designs.

The method of inquiry revolves around the idea of space making and spatial conception from a human aesthetic point of view. Understanding that the spaces conceived are somewhat direct correlations to the ratio in conceptual form, but with the intent to create and hold onto the idea that the ratio exists as the primary system in the experiments.

The drawings and models are an attempt at conceiving and making with the golden ratio at its most basic level of understanding so that any new found knowledge can be applied later to the architectural interpretations intended for this thesis.
Before initiating any kind of models or assumptions about the ratio, I wanted to make sure I understood how to sketch and draw the diagram from its most basic understanding. This included techniques on geometry and measurement to construct the original spiral diagram.

With this basic understanding I could essentially create the diagram from scratch and begin to learn how to overlay the properties over other examples to correlate connections.

Once drawn and sketched on paper I did a study in perspective to correlate the idea of the ratio on aesthetics and the eye. One of the questions I asked was "does the ratio correlate when moved into perspective through an exploded axon?" It was a study that also began to help me understand how the eye will interpret the 2 dimensional drawing to a 3 dimensional concept and whether the form translates. I came to conclude that while it does become rather literal there is potential for it to become something quite unique.
Correlating Diagrams Study

The basic proportions and formulas used to create the diagram led to me recreating some simple diagrams that would help in better understanding of how other geometries interact with the drawing. These diagrams explore different ways to draw and make connections of lines and points that intersect throughout.
2.3 | Volume Series

With the volume series I wanted to observe how the ratios of rectangular prisms would work when juxtaposed on the same plane. This series explores the law of the similar in that each volume is based on the golden ratio at different proportions. The law of the similar implies doesn’t imply the same size but the same shape and in corresponding sizes of a ratio. The numbers represent the ratio relationships of each rectangular prism.

The observable qualities are purely for understanding how change in the ratio starts to affect how we view harmony among sizes. The exploration sequence scrutinizes whether or not the ratio is objectively harmonious or not. Arguably the sequences have different levels of harmony and levels of disharmony.

The harmony then becomes reliant on a successful composition. Therefore the volumes cannot objectively be called beautiful or aesthetically pleasing unless the composition is ordered in a way that doesn’t cause a disturbance. Unless the intent is to disturb the normal.
The axis series looks at the ratio quite literally and applies the element of space, void and structure | framework into the experiment. Looking at how we might start to conceive space created by the proportioned elements of the ratio.

The series explore the X,Y and Z as axes to move along and manipulate. Intersection of lines and planes plays a part and acts as a force that the ratio must coincide with, but still with the intent of relying on the ratio for all decisions to be made.

The experiment produces an unexpected variance in that the models could be turned and twisted to really create something not intended, but quite interesting when thinking about how space could be constituted with the golden ratio.
The final artifact is an abstraction of the concepts being explored in the series with the addition of some architectural elements to help illustrate how the object may start to become a conceivable and habitable space. The series comes together to create a form where the modeling concepts intersect, twist and change. Studying the consequence of manipulation of order in design.

The large artifact was created by inspiration of combining the axis series illustrated below. This was a small idea that transformed how I began to contemplate abstracting my framework and composition. It created an interesting combination of intersection through purely having the models interact and cross over each other.
3.1 | Selection of Techniques

My experiments proved to be successful in their attempt to help me understand how I might begin to create with the ratio, but in order to create a richer architectural intervention I sought methods or techniques used by other architects in the field of mathematical and geometrical manipulation.

Joseph Choma and Bernard Tschumi both approach the problem of changing geometry to their will, but with an approach similar in nature. Ideologies that I could benefit in understanding how to begin to manipulate the golden ratio to create something unique to my concepts, but staying true to the golden ratio as the key principle in design.

For each architect, I attempted to reconcile their method so that it can be applied to my individual interrogation and approach on creating with the golden ratio in an urban planning strategy and experimental folly that started out as a simple geometric form.
As a grand project of the French government in 1982, President Mitterrand organized a competition which invited over 470 teams from 70 countries. The brief of the contest was to create a master plan for an “Urban Park for the Twenty-first Century” to accommodate entertaining and cultural facilities such as outdoor theaters, art galleries, restaurants, etc. In March 1983, Bernard Tschumi, a French-Swiss architect, won the project with a large metropolitan proposal.

An award-winning project noted for its architecture and new strategy of urban organization, La Villette has become known as an unprecedented type of park, one based on “culture” rather than “nature.” The park is located on what was one of the last remaining large sites in Paris, a 125-acre expanse previously occupied by the central slaughter houses and situated at the northeast corner of the city. In addition to the master plan, the project involved the design and construction of over 25 buildings, promenades, covered walkways, bridges, and landscaped gardens over a period of fifteen years. A system of dispersed “points”. The red enameled steel follies that support different cultural and leisure activities are superimposed on a system of lines that emphasizes movement through the park.

The project originally peeked my interest due to its unique approach on the folly development, but also at how Tschumi designed the landscape and layout of the park. The illustrations to follow will demonstrate both the creativeness in Folly design, but also park design created a visual experience inspired by deconstructivism.

Description: ‘La Villette aims at an architecture that means nothing, and architecture of the signifier rather than the signified - one that is pure trace or play of language’ (Tschumi, 1994)
3.3 | Parc De La Villette Concept Drawings
3.4 | Joseph Choma Research

Joseph Choma is an Assistant Professor of Architecture at Clemson University and the founder of the Design Topology Lab, an interdisciplinary design research practice. His research interests lie at the intersection of perception, computation, epistemology and pedagogy.

He is the author of MORPHING: A Guide to Mathematical Transformations for Architects and Designers (Laurence King Publishing, January 2015). Simultaneous to his research, he is investigating the blurring of perceived spatial boundaries with large inhabitable drawing installations.

The two projects illustrated demonstrate his look at the 2D and 3D fabrication of his research. His studies in mathematics and geometry proved of interest to me for its potential application in smaller scale manipulations to create an architecture.

A quote from Joseph Choma, “A shape can be defined symbolically, like a specific platonic solid, or a shape could be examined through the lens of plasticity, in which all shapes are considered interconnected and related.” This precise description sparked an interest in how the 2D and 3D realms can be interpreted.

Description: ‘Thousands of lines are scratched at a depth of 0.02” into glossy black painted medium density fiberboard panels. Fibers are lifted like carpet with an air compressor. As you walk inside, you feel perceptually attached.’ (Choma, 2013)

Installation Photography
Form Progression Series

Load Diagrams of Form

Pneumatic Pavilion | Joseph Choma

Fig 3.17
Fig 3.18
Fig 3.19
Fig 3.20
Fig 3.21
3.5 | Workshop Artifact

I had the pleasure of taking a workshop hosted by Joseph Choma and was able to produce an artifact through his methodology of study in his field.

The piece is entitled beautiful duel and is a final representation of geometrical manipulations through a script in the software Rhino 3D. The script was created by Joseph Choma as a tool for applying mathematical algorithms to create a shape and then manipulating that formula to give a desired effect. This process can be random in its generation of form, but is a great way to start to abstract an original shape to something completely different.

The shape I chose to manipulate was a torus. Through a series of trial and error I eventually produced a shape that I began to imagine as an experiential space illustrated in the render.
4.1 Site Selection

With the Bernard Tschumi Study I realized there was an opportunity to create interesting follies with his concepts, but also utilize the new found knowledge to design and inform a site. I could in turn use this designed site to create a foundation for the follies I am looking to apply geometric and mathematical manipulation to.

The site acts as a test of this Tschumi method of understanding the existing grid, ratios, and geometries the site has and then applying the golden ratio as the key system that informs the new.

Centennial Olympic Park in Atlanta was chosen for the site to offer an opportunity to redesign an outdated park with a system that could offer functionality, beauty and a foundation for the follies to be placed.
The park is surrounded by many major Atlanta landmarks; the Georgia World Congress Center, College Football Hall of Fame, State Farm Arena, the CNN Center, and Mercedes-Benz Stadium are all on the west side of the park and the Georgia Aquarium, National Center for Civil and Human Rights, and the World of Coca-Cola on the north side of the park. It is bounded by Marietta Street to the west, Baker Street to the north and Centennial Olympic Park Drive to the east and south. Andrew Young International Boulevard, named for the former Atlanta mayor and United Nations ambassador, runs through the southern portion of the park.

Unknowing to most who visit, extends across Baker ST NW between the world of coke museum and the aquarium. With my intervention of follies I am looking to connect these separated portions and bring interaction to the spaces that aren’t seeing as much activation.

The park layout is generally open, but does have the ability to be closed off. This feature allows it to act as great point of crossing and activity, but with unfortunately some unusual paths that used to outline older spots of activity for the Olympics, but no longer have that same purpose. This makes for confusing lines of circulation and even wasted space. My design will look to create more intentional pathing for the site that coincides with park goers love to wander and for those who love to use the park as a direct path of circulation for commuting to the other sides.

The park includes several amenities that I wanted to retain, so to keep the essence similar I have reorganized the existing programs so that it still holds onto its character, but with an emphasis on the parks new attractions with the follies.
4.3 | Site History & Context

Pre-Olympics Timeline

Way back in the 1850s, when Atlanta was no more than a railroad town of a few thousand people, the land that would become Centennial Olympic Park sat at the outskirts of the city.

1850

Nearing the turn of the century, the first complete Sanborn Map of the park area appears. At the park site, homes had filled every available lot northward to Baker Street, while the industrial warehouses loomed large over the southern tip of the site.

1886

The city had yet to build its first skyscraper — the Equitable Building — but growth had crept westward along the railway to the area of Centennial Olympic Park. In 1886, the year of Henry Grady’s “The New South” Speech, Coca-Cola was invented.

1892

On the final Sanborn Map produced of the area in 1911, the northern portion of the site is still dominated by residential. But as Atlanta became the powerhouse of industry in the region, warehouses and other industrial spaces ate into the neighborhood.

1911

The 1980s brought what can earnestly be called rock bottom. In a recent article, Maria Saporta described the area as “one of the least attractive spots in downtown Atlanta.” Even still, some visionaries began to see that the area had potential — or that cheap land was too good of a value to pass up.

1980

Centennial Olympic Park was constructed in two phases. Phase I of construction was completed July 1996, just in time for 1996 Olympic Summer Games at a cost of US $28 million. During the Olympics, the park contained sponsor exhibits, hosted entertainment and medal presentations.

1994

Head of the Atlanta Committee for the Olympic Games Billy Payne recommended that the city create a large gathering space in downtown that would serve as a central gathering space during the games. In 1994, it was decided that the derelict, abandoned industrial neighborhood just north of the railroad tracks would serve as the perfect place for a park.

1996

Construction Phases Original Park

Pre-Park

Pre-Olympics

During Olympics

Post-Olympics

Fig 4.6

Fig 4.7

Fig 4.8

Fig 4.9
One of the integral processes in helping to reconcile some of the big moves during the design of the site was through development of parti diagrams in model and sketch form. The background of this spread is the combination of some of the rough sketches used in drawing and layering different ratios, grids and concepts of program placement.

The three landscape sketches are attempting to understand the different levels and density of greenery throughout the site. The path was the most notable factor informed by the geometry of the site and the golden ratio that I kept constant in the studies.

The parti concepts and final model was taken on the Bernard Tschumi study in chapter 04 with the exploded layers representing circulation, grid placement and ultimately where the follies could be placed.
Parti Models

Parti 01 | Dividing the Site

Parti 02 | Cohesive Flow

Parti 03 | Axis Pivoting

Parti 04 | Combining Axes
Throughout the design it was important to make sure that upon development I had to design around the use of the golden ratio. In order to do this, I had to analyze the site’s geometry and grid system to find some kind of epicenter for a foundation of the proportioning of the site. The axis elaborated by the gray path serves as the representation of the ratio.

The grid and buildings around the park served as site forces to test the ratio within composition. The natural curves of the site were refined and elaborated by the proportion and emphasized connection between the two ends of the park. Connection of the parks across the street was something that needed to be emphasized and developed.

The follies along the parti/path are a reaction of the grid system and natural flow of the site. It was important to move the follies from the grid so that I could create a more exploratory experience between the follies instead of placing them directly on the axis.

The illustrations to the right represent the final park design as well as the site informing series to give clarity on the moves made to construct the armature of the site in accordance to the golden ratio.
1) Existing Grid | Site Blocks
- Blocks of site distribution
- Diagonals of geometry
- Grid extended to city

2) Existing Grid | Divided
- Divided grid (1/2)
- Offset grid
- Diagonal grid

3) Refinement | Subdivided
- Subdivided grid (1/4)
- Common axis
- Diagonal grid

4) Contours | Site Slope
- Existing contours
- Site outline
- Lowest to highest

5) Parti | Natural Flow
- Existing subdivided grid
- Folly placement
- Site gesture flow

6) Refinement of Curve
- Unrefined path
- Influencing geometry

7) Existing Program
- Entrances
- Pavilions & buildings on site
- Monuments
- Fountains

8) Site Density | Interaction
- Common paths on site
- Higher density areas
- Subdivided grid

9) Folly Placement
- Main grid
- Subdivided grid
- Site parti path
- Folly
5.1 | Folly Synopsis

The definition of a folly in architecture is a building constructed primarily for decoration, but suggesting through its appearance some other purpose. The design does not necessarily require a program and is meant to be viewed and experienced to illustrate an idea architecturally.

My series of follies take some of the geometrical, mathematical and compositional principles discussed in this book to create a unique experience that evokes curiosity and a sense of awe in how it might be built. The follies, originally intended for a park setting, have now evolved to a level of experimentation in rendering schemes that opens up the imagination to how follies could be placed in more dramatic settings.

Proportion and scale, two of the key components in designing with the golden ratio, are exaggerated and explored in a conceptual method that suggests something seemingly impossible. Creating a hyper future architecture that interrogates what a folly can be. The intent however is still to hold true to the golden ratio as the key principle in design as well as the associated geometry. I invite you on an architectural journey unlike any you have ever seen...
5.2 | 01_Emergence

The translation of a circle to a torus was the inspiration for the geometry of this piece. The artifact that encapsulates the form was a progression of adapting different components based on the change in proportion of the ratio to determine the multiple layers.

Emergence is the first of the series and demonstrates the grandness of the circle. Those who fall upon its gaze may find themselves somewhere else entirely the next day.
The concept of this piece was to combine the circle and spiral from the golden ratio geometry and create a piece that takes the concept of scale and proportion to another level of monumental.

Mother and Sun is a dance of architectural dragons that en-wrap a small sphere resembling a sun. Anyone who bears witness to its majesty experiences a sense of warmth, comfort and awe.
5.4 | 03_Ace Triad

With the combination of the square and triangle in this series the construct creates an interesting tension around the cube, as if it is protecting or encapsulating it.

Ace Triad appears almost as if it will take off at any second with the four tri-artifacts that look like some type of craft. Anyone who comes close will be given a sense of captivity and interest at the follies intention.
Symbolically the square represents the physical plane, earth and a laying of foundations. It also attributes the need for stability. In this piece I layered the different proportions of the square surrounding a core to create that sense of security and control associated with the shape.

Metatron’s Core emits a strange glow from the inside. The energy is quite palpable for those that stand close enough, almost as if it is alive.
The pentagon naturally forms a start when arranging the proportions and geometries. This provided the concept of the piece as it takes the shape of a star surrounded by a geodesic icosahedron.

Asteria Complex creates its own orbital field that gives a sense of enclosure and compression. As you approach you almost feel yourself being pulled in. Perhaps gravity works differently with this folly.
ASTERIA COMPLEX
The hexagon is utilized in this iteration to create the immense colonnades and portal at the end. Through careful manipulation of the geometry and layering I created a hall with a dynamic feel and repetition to guide circulation.

The last of the follies represents the end of our journey through the investigation and interrogation of the golden ratio. It’s been long and rewarding, but now it is time to go home...
TIME TO GO HOME...
6.1 | Final Reflection

My perspective on the golden ratio from the beginning of my research to the end changed completely. I had known so little about this system and really had to dig deep to uncover what was real and simply pseudo-scientific evidence. However, my admiration for the theory and capabilities of the ratios use only grew.

My studies showed that there is connection to nature, human proportion and even in some architecture. But not to the extent that some may be fooled into believing. Generally its mathematical properties are correctly stated, but much what is presented about it in art, architecture, literature and aesthetics is false or seriously misleading.

The ratio is a tool to which you can create and develop a concept and create a set of parameters that help in guiding order. The geometric properties were fascinating connections to make, and while I can’t confirm it be the most beautiful is was certainly capable of creating something aesthetically interesting and captivating. The exploration through the follies proved to be a great method of interrogation and creative expression while also demonstrating that the constraints of the system are entirely dependent on the mind of the designer.

I hope that this book brings you an educated appreciation for the system and hopefully a little inspiration in how it can be used. Thank you.
6.2 | Presentation Boards

A CSA Conference Board

GOLDEN SCRUTINY
Analog-to-Digital

Student Name: Devon Samis  |  Advisor Name: Peter Pittman
Department of Architecture, Kansas State University

PROJECT
The golden ratio can be found in art, architecture, human anatomy, and nature throughout history. One of the most widely known representations of this ratio is the Vitruvian Man, a drawing created by Leonardo Da Vinci. This drawing illustrates how the human body proportionally relates to the golden ratio, also known as the Fibonacci sequence. The golden ratio, also called divine proportion, is used as a design tool to create aesthetically pleasing compositions and layouts.

GOLDEN SCRUTINY | INQUIRY

ABSTRACT
This abstract will focus on the golden ratio and its application in architecture, specifically in adherence to a contemporary application. Through the investigation of this application, the question will be addressed of whether proportion interrelates and supports all the other factors in the design process.

METHOD OF INQUIRY
In order to sustain a discussion of the golden ratio and its application in architecture, a research methodology was developed. This methodology includes the analysis of literature real occurrences, or do.

QUESTIONS TO CONSIDER
What is the golden ratio? How is the golden ratio utilized in laying out and designing space? Why is the golden ratio so significant in discrete use in art and architecture and what sets it apart from other proportion systems?

GOLDEN RATIO | INTRODUCTION

Euclid wrote many books within his Elements series. Book V has propositions about ratios and magnitudes such as “Parts have the same ratio as their equimultiples”. He makes many statements about information about ratios and proportions. However, these were only statements of size between two magnitudes of the same kind. He did not understand the concept of proportion as a ratio, in a similar sense to today’s mathematics for the ratio was not divided into two terms.

The golden ratio, also called divine proportion, is a mathematical calculation used in many fields such as art and architecture. It is a proportion that has been used throughout history in order to achieve aesthetic harmony. This ratio is based on the Fibonacci sequence, which is a series of numbers where each number is the sum of the two preceding ones.

The golden ratio is approximately 1.618 and it appears in many natural and man-made objects. It is believed that the golden ratio is aesthetically pleasing and has been used in art and architecture for centuries.


timELINE | RATIO USES

3000BC - TODAY

PHIDIAS (500 BC – 432 BC)


deliberately used the golden ratio in sculptures for the Parthenon.

Euclid wrote many books within his Elements series. Book V has propositions about ratios and magnitudes such as “Parts have the same ratio as their equimultiples”. He makes many statements about information about ratios and proportions. However, these were only statements of size between two magnitudes of the same kind. He did not understand the concept of proportion as a ratio, in a similar sense to today’s mathematics for the ratio was not divided into two terms.

The golden ratio, also called divine proportion, is a mathematical calculation used in many fields such as art and architecture. It is a proportion that has been used throughout history in order to achieve aesthetic harmony. This ratio is based on the Fibonacci sequence, which is a series of numbers where each number is the sum of the two preceding ones.

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The golden ratio is approximately 1.618 and it appears in many natural and man-made objects. It is believed that the golden ratio is aesthetically pleasing and has been used in art and architecture for centuries.
**Methodology**

The golden ratio is a mathematical concept that has been used in various fields, including art, architecture, and design. It is often used to create aesthetically pleasing compositions. In the context of this project, the golden ratio was used to inform the design process.

**Precedents | Geometric Governance**

Bernard Tschumi | Parc La Villette

- **Parc La Villette**
  - The site is divided into a grid system consisting of multiple layers. Each layer represents a different aspect of the park's design.
  - The grid system is used to inform the placement of follies and other elements within the park.

**Site Selection | Centennial Park**

- **Centennial Park**
  - The site is located in Atlanta, Georgia, near the University of Georgia campus.
  - The park was designed to serve as a central gathering space during the 1996 Olympic Games.

**Site Narrative**

The site narrative is divided into several parts:

1. **Park Abstraction**
   - The park is divided into segments, each of which is represented by a specific color.
   - The segments are arranged in a grid system.

2. **Fountains and Pavilions**
   - The park contains several fountains and pavilions, each of which is represented by a specific symbol.
   - The fountains and pavilions are arranged in a grid system.

3. **Park Adaptation**
   - The park is adapted to accommodate various activities, such as sports, music, and entertainment.
   - The adaptations are represented by specific symbols.

4. **Park Development**
   - The park is developed over time, with new elements being added.
   - The development is represented by specific symbols.

**Site Design | Park Adaptation**

- The park is adapted to accommodate various activities, such as sports, music, and entertainment.
  - The adaptations are represented by specific symbols.

**Site Plan Abstraction Studies**

- The site plan is abstracted to inform the design process.
  - The abstracted site plan is used to inform the placement of follies and other elements within the park.

**Site Analysis**

The site analysis is divided into several parts:

1. **Partial Grid**
   - The site is divided into a grid system consisting of multiple layers.
   - Each layer represents a different aspect of the park's design.

2. **Offset Grid**
   - The grid system is offset to inform the placement of follies and other elements within the park.

3. **Subdivided Grid**
   - The grid system is subdivided to inform the placement of follies and other elements within the park.

4. **Diagonal Grid**
   - The grid system is diagonal to inform the placement of follies and other elements within the park.

**Site Modeling**

The site modeling is divided into several parts:

1. **Folly Models**
   - The follies are modeled using digital tools.
   - The models are used to inform the design process.

2. **Paradigm Selection**
   - The paradigm selection is used to inform the design process.
   - The selection is based on specific criteria.

3. **Paradigm Development**
   - The paradigm development is used to inform the design process.
   - The development is based on specific criteria.

4. **Paradigm Transformation**
   - The paradigm transformation is used to inform the design process.
   - The transformation is based on specific criteria.

**Site Evaluation**

The site evaluation is divided into several parts:

1. **Paradigm Evaluation**
   - The paradigm evaluation is used to inform the design process.
   - The evaluation is based on specific criteria.

2. **Paradigm Assessment**
   - The paradigm assessment is used to inform the design process.
   - The assessment is based on specific criteria.

3. **Paradigm Synthesis**
   - The paradigm synthesis is used to inform the design process.
   - The synthesis is based on specific criteria.

4. **Paradigm Implementation**
   - The paradigm implementation is used to inform the design process.
   - The implementation is based on specific criteria.

**Site Implementation**

The site implementation is divided into several parts:

1. **Paradigm Implementation**
   - The paradigm implementation is used to inform the design process.
   - The implementation is based on specific criteria.

2. **Paradigm Evaluation**
   - The paradigm evaluation is used to inform the design process.
   - The evaluation is based on specific criteria.

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6.3 | References

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Key Terms

Abstraction: A distillation of a basic idea or parti into its most significant or telling parts.

Additive Forms: Characterized by a basic progress which involves adding simple solids together to make a more complex whole.

Balance: The pleasing or harmonious arrangement or proportion of parts or elements in a design or composition.

Cartesian Space: Based on the X, Y, Z coordinate system of Rene’ Descartes, an infinitely expandable and homogeneous space defined by a square grid.

Composition: The arranging of parts or elements into proper proportion or relation so as to form a unified whole.

Concept: A mental image or formulation of what something is or ought to be, esp. an idea generalized from particular characteristics or instances.

Dome: A hemi-spherical vault or capula supported by a circular wall or drum or by corner supports.

Form: The shape and structure of something as distinguished from its substance or material.

Geometry: The mathematical discipline which deals with measurements, relationships and properties of points, lines, planes, angles, and figures in space.

Golden Rectangle: A rectangle whose proportions embody the relationships of the golden section. A golden Rectangle can be infinitely decomposed into a square and another golden rectangle.

Grid: A framework of crossed lines; common architectural grids are four-square and nine-square.

Hierarchy: A system of things, spaces, or areas ranked one above the other in series.

Idea: A thought or notion resulting from mental awareness, understanding, or activity.

Juxtaposition: The close placement of elements which may have no relationship other than their adjacency.

Line: The edge or contour of a shape.

Order: A condition of logical, harmonious, or comprehensible arrangement in which each element of a group is properly disposed with reference to other elements and to its purpose.

Organization: The systematic arranging of interdependent or coordinated parts into a coherent unity or functioning whole.

Parti: From the French verb ‘parti’ meaning ‘to leave’ or a point of departure, used in architecture to designate the basic organization of a design.

Platonic Solid: Based on the theories of the Greek philosopher Plato, Platonic or primary shapes are rooted or extended to generate primary volume which are the sphere, cylinder, cone, pyramid, and cube.

Point: The major idea, essential part or salient feature of a narrative or concept.

Proportion: The comparative relations between dimensions or sizes.

Rhythm: Repetition or system with uniform pattern or beat recurrence.

Shape: The outline or surface configuration of a particular form or figure.

Superimpositions: The simultaneous presence of two or more forms, one atop the other.